

A Stable, Extreme Temperature, High Radiation, Compact. Low Power Clock Oscillator for Space, Geothermal, Down-Hole & other High Reliability Applications, Phase I

Completed Technology Project (2004 - 2004)



Project Introduction

Efficient and stable clock signal generation requirements at extreme temperatures and high radiation are not met with the current solutions. Chronos Technology proposes to evaluate RTXO as a new and comprehensive solution that simultaneously addresses the requirements of a reliable clock source in extreme environments. RTXO utilizes the larger band-gap, smaller intrinsic carrier concentration, high radiation tolerance and extreme temperature capabilities of Silicon Carbide (SiC-4H) semiconductor technology. We will validate (thru FEA & other analysis) the trade-offs of advanced, high-Q Quartz and Gallium orthophosphate resonator material (in thickness shear mode resonance), configuration, processing, electronic interface and a matched mechanical support structure. Packaging technology approach addresses the unique needs of integrating an environmentally sensitive high-Q resonator operating in the same environment as the rest of the components. Suitable processes will be evaluated to yield reliable and repeatable manufacturing of RTXO as a viable and real life solution. All the different elements and processes identified in this solution must comply and dovetail in order for a compact, robust, mono-metallically interconnected and hermetically sealed housing configuration (interconnection) to encapsulate the assembly. RTXO technical objective is to deliver exceptional performance over temperature ranges from -100°C and exceeding 400°C and radiation exceeding 300Krad (TID).

Anticipated Benefits

The need for extreme temperature clock as offered by RTXO will be acute in advance jet engine controllers to facilitate more precision control for future more efficient engines. Geothermal monitoring sensors will offer applications for RTXO where current solutions literally fall short of performance and reliability with the additional benefit of reduced maintenance cost. Down-hole industry is quite sensitive to, and would benefit from improved precision of their electronics as well as avoidance of system failure and associated cost. State of the art down-hole systems requiring synchronization between the down-hole portion and ground surface modules will directly benefit from RTXO. RTXO will benefit system applications that are required to operate in extreme environments such as missions to Venus and Mars where all current and available solutions fail due to extreme temperature operating requirements. Furthermore, RTXO is intended to be a high performance but a standard solution for space qualified clocks that NASA always treats as a custom made and controls them thru elements from NASA doc# 311-INST-001, MIL-PRF-38534 & MIL-PRF-55310. RTXO will be used in all sensors, control and communication modules in orbiter or landing modules of space vehicles. It can also be used in synthesizers, filtering and demodulation applications.



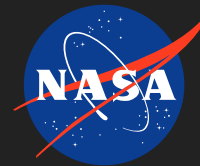
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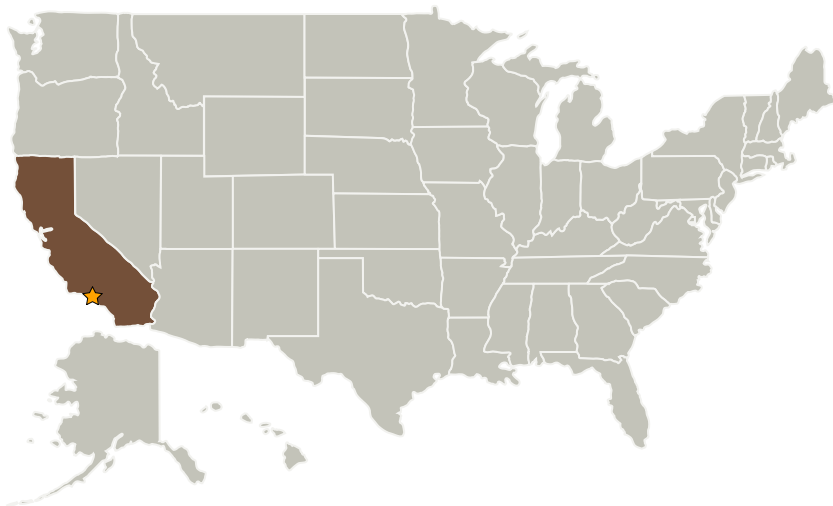
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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Jet Propulsion Laboratory (JPL)	Lead Organization	NASA Center	Pasadena, California
Chronos Technology (Div. of FMI, Inc.)	Supporting Organization	Industry Women-Owned Small Business (WOSB)	Huntington Beach, California

Primary U.S. Work Locations

California

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Jet Propulsion Laboratory (JPL)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Project Manager:

Celestino Jun Rosca

Principal Investigator:

Kouros Sariri

Technology Areas

Primary:

- TX02 Flight Computing and Avionics
 - ↳ TX02.3 Avionics Tools, Models, and Analysis

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Technology Areas
(cont.)

- └ TX02.3.2 Space
Radiation Analysis and
Modeling